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## PECULIARITIES OF MEASLES DURATION IN THE CHILD CONTINGENT

*Horlenko O., Polyak M., Polyak-Tovt V., Hema N., Horlenko F., Piridi V.*

*Uzhgorod National University, Medical Faculty, Uzhhorod, Ukraine*

### Introduction

Duration of Measles is a very topical medical and social problem. Measles is an acute viral and antropozoonose disease with intoxication, catarrhal lesions of the upper respiratory tract and macula - papular rash. In the pre-vaccination period the disease was spread everywhere and was as one of the leading causes of death in the children. From January 2011, more than 30 thousand cases of measles among all age groups - from babies to adults, were recorded in the 29 countries of the European region, according to the latest WHO data. In Ukraine were observed in 2001 - 16 970 cases, 2006 ( 42,724 cases) and 2012( 12 746 cases) according to a retrospective analysis of measles. The duration of the current epidemic process dictates the need for a whole set of preventive and anti-epidemic measures and

requires increased attention of the doctors for early diagnosis and prevention of measles.

### The aim of the work

Aim of the present study is to evaluate the problem of duration of measles in the children, depending on vaccination.

### Material and methods

We investigated child contingent with Measles in the Zakarpattya region (135 children, age  $26,68 \pm 1.37$  months) with regard of vaccination.

### Results

We present comparative analysis of measles with regard to vaccines. In the table 1 we show the peculiarities of measles in the cases of vaccinated and nonvaccinated children.

Table 1

**Measles clinical signs in the cases of vaccinated and nonvaccinated children**

Parameters	Vaccinated (n=66)		Non-vaccinated (n=69)		P
	n	%	n	%	
Decreased appetite	66	100	69	100	p>0,05
Weakness	66	100	69	100	p>0,05
Headache	33	50	42	60,87	p>0,05
Eye redness	66	100	69	100	p>0,05
Light sensitivity	24	36,36	40	57,97	p<0,05
Secretion	38	57,58	46	66,67	p>0,05
Stuffy nose	66	100	69	100	p>0,05
Mucus secretion	66	100	69	100	p>0,05
Cough	66	100	69	100	p>0,05
Dyspnea	12	18,18	35	50,72	p<0,001



Nausea	7	10,61	7	10,14	p>0,05
Vomiting	7	10,61	7	10,14	p>0,05
Stomach ache	17	25,76	18	26,09	p>0,05
Fluid stool	23	34,85	52	75,36	p<0,001
Catarrh syndrome - less than 5 days	39	59,09	24	34,78	p<0,05
-more than 5 days	27	40,91	45	65,22	p<0,01
Temperature: 37-38 C	3	4,55	12	17,39	p<0,05
38-39 C	29	43,94	37	53,62	p>0,05
39-41 C	34	51,52	20	28,99	p<0,01
Complications: Acute unilateral pneumonia	3	4,55	10	14,49	p<0,05
Acute bilateral pneumonia	4	6,06	6	8,70	p>0,05
Acute bronchiolitis	1	1,52	11	15,94	p<0,01
Acute bronchitis	11	16,67	20	28,99	p>0,05
Acute obstructive bronchitis	5	7,58	8	11,59	p>0,05
Acute catarrhal otitis media	-	-	1	1,45	-
Days of curation -1-5 days	41	62,12	2	2,90	p<0,001
-6-10 days	23	34,85	57	82,61	p<0,001
- more than 10 days	2	3,03	10	14,49	p<0,05

*Note.* P- liability of the data in the case of vaccinated and nonvaccinated children.

While comparing the data of the two groups we can see the difference in the majority of parameters. The illness is harder in the case of nonvaccinated children, for example: light sensitivity – 24 (36,36%) to 40 (57,97 %),  $p<0,05$ ), dyspnea 12 (18,18 %) to 35 (50,72 %),  $(p<0,001)$ , fluid stool 23 (34,85 %) to 52 (75,36 %),  $(p<0,001)$ . In the case of 39 (59,09 %) vaccinated children catarrh syndrome was longer than in the case of nonvaccinated children – 24 (34,78%),  $(p<0,05)$ , but there was reversible reaction during 5 days 27 children (40,91%) and 45 children (65,22 % in the groups),  $(p<0,01)$ . In the case of vaccinated children the temperature (39-41 C) was more typical, while in the case of nonvaccinated ones, the temperature (37-39 C) was more typical. The period of fever was longer in the case of nonvaccinated children  $6,16\pm 0,15$ , than in the case of vaccinated

ones, –  $5,75\pm 0,41$  days. The data concerning the complications were more liable: acute unilateral pneumonia – 3 (4,55 %) to 10 children (14,49 %) in the groups,  $(p<0,05)$ , acute bilateral pneumonia – 4 (6,06 %) to 6 children (8,70 %), acute bronchiolitis – 1 (1,52 %) to 11 (15,94 %)  $(p<0,01)$ , acute bronchitis – 11 (16,67 %) to 20 (28,99 %) in the groups and acute obstructive bronchitis – 5 (7,58 %) to 8 children (11,59 %). In the case of 24 vaccinated children (36,38 %) and 55 nonvaccinated (79,71 %) we recorded complications of breathing. Because of the greater amount of complications in the case of nonvaccinated children the period of curation was longer. The children curation – less than 5 days long – is typical for vaccinated children  $(p<0,001)$ , whereas more than 10 days long – for nonvaccinated children  $(p<0,05)$ . We also conducted biochemical serum tests.



Table 2

### Biochemical tests of venous blood serum in the children with measles

Parameters	Vaccinated (n=32) M±m	Nonvaccinated (n=35) M±m	P
Direct Bilirubin (mkmol /l)	3,20±0,70	1,73±0,26	p>0,05
Bilirubin (mkmol /l)	6,30±0,68	5,69±0,44	p>0,05
Protein total (g/l)	63,77±1,67	61,44±1,56	p>0,05
Albumen (g/l)	40,77±1,16	41,78±1,15	p>0,05
ALAT (IU/l)	30,23±4,78	35,50±2,69	p>0,05
ASAT (IU/L)	64,00±4,87	52,00±8,49	p>0,05
GGT (IU/L)	15,15±1,45	15,00±1,41	p>0,05
Urea (mmol/l)	2,30±0,16	2,67±0,17	p>0,05
Creatinine (mkmol /l)	45,28 ±2,00	55,80±8,67	p>0,05
Alkaline phosphatase (IU/l)	280,77±29,73	281,75±25,23	p>0,05
Thymol test (IU)	4,34±0,60	3,40±0,19	p>0,05
Glucose (mmol/l)	5,22±0,10	5,21±0,10	p>0,05
Amilasa (g/l)	17,97±1,74	19,03±1,77	p>0,05

*Note.* P- liability of the data in the case of vaccinated and nonvaccinated children. According to our exploration, there is no difference between the groups.

We also analyzed mineral balance in the groups.

Table 3

### Mineral balance in the children with measles

Parameters (mmol/l)	Vaccinated (n=34) M±m	Nonvaccinated (n=41) M±m	P
Potassium	3,87±0,11	4,19±0,16	p>0,05
Natrium	137,84±0,50	137,98±0,41	p>0,05
Chlorine	102,91±0,58	104,46±0,84	p>0,05
Calcium	2,24±0,01	2,23±0,02	p>0,05

*Note.* P- liability of the data in the case of vaccinated and nonvaccinated children.

We can see minimal growth of Potassium and Chlorine in the nonvaccinated children cases. Here are the results of immunological status analysis.



Table 4

**Immunological status analysis**

Parameters	Vaccinated (n=32) M±m	Nonvaccinated (n=35) M±m	P
Il-1 (pg/ml)	0,86±0,09	1,17±0,15	P<0,01
Il -2 (pg/ml)	9,69±0,39	8,95±0,40	P>0,05
Il-6 (pg/ml)	28,04±5,71	44,59±5,21	P<0,01
Il - 10 (pg/ml)	18,73±2,04	18,56±2,63	P>0,05
Interferon - γ (pg/ml)	80,73±13,95	84,16±13,80	P>0,05
Neopterinum (nmol/l)	115,19±7,51	115,78±9,30	P>0,05

Note. P- liability of the data in the case of vaccinated and nonvaccinated children.

We can see high levels of IL-2, IL-6, IL-10, IF-γ and neopterinum. According to our data, we can see clear domination of the levels of IL-1 (0,86±0,09 to 1,17±0,15), (p<0,01) in the groups and IL-6 (28,04±5,71 to 44,59±5,21), (p<0,01)

which correlates with the period of catarrh syndrome (more than 5 days 27 (40,91±6,05) to 45 (65,22±5,73) and the period of fever (5,75±0,41 to 6,16±0,15) in the groups. Here is the data of microelement analysis of blood plasma.

Table 5

**Mineral balance in the children with measles**

Parameters	Vaccinated (n=43) M±m	Nonvaccinated (n=48) M±m	P
Iron (mmol/l)	36,68±4,21	33,16±5,74	p>0,05
Copper (mg/l)	0,41±0,04	0,64±0,04	p<0,05
Zinc (mg/l)	0,55±0,04	0,55±0,03	p>0,05
Phosphorus (mmol/l)	707,21±40,05	544,30±49,03	p<0,01
Iodine (mg/l)	69,9±0,58	64,7±0,69	p<0,05

Note. P- liability of the data in the case of vaccinated and non-vaccinated children.

In the group of non-vaccinated children we can record the decrease of copper (0,41±0,04 to 0,64±0,045 mg/l), (p<0,05), phosphorus (707,21±40,05 to 544,30±49,03,p<0,01)

and Iodine (69,9±0,58 to 64,7±0,69 mmol/l, p<0,05).

We also conducted multifactorial regressive analysis in the groups.



Table 6

**Data of multifactorial regressive analysis in the group of Non-vaccinated children**

Parameters	Tests	$\beta$	P
Enlargement of the liver	Direct bilirubin	0,38	p<0,05
	ALAT	0,56	p<0,05
	IL-6	-0,42	p<0,05
	Iron of plasma	-0,56	p<0,05
Increased liver echogenicity	Total protein	0,69	p<0,05
	Albumen	0,88	p<0,05
	ALAT	0,47	p<0,05
Enlargement of the pancreas	Direct bilirubin	0,70	p<0,001
	Total protein	0,88	p<0,001
	ALAT	0,46	p<0,01
	IL-2	0,42	p<0,05

According to results in the case of nonvaccinated children we can record dependency of liver size and level of direct bilirubin ( $\beta=0,38$ ), ALAT ( $\beta=0,56$ ), IL-6 ( $\beta=-0,42$ ) and Iron level of blood serum. ( $\beta=-0,56$ ), (p<0,05). Increased liver echogenicity interconnected with the levels of total protein ( $\beta = 0,69$ ),

albumin ( $\beta = 0,88$ ), (p<0,001), and ALT ( $\beta = 0,46$ ). Enlargement of the pancreas caused by levels of direct bilirubin ( $\beta = 0,70$ ), total protein ( $\beta = 0,88$ ), (p<0,001), ALT ( $\beta = 0,46$ ) and IL-2 ( $\beta = 0,42$ ), (p<0,05). Mutual dependency of these factors can be recorded in the case of vaccinated children.

Table 7

**Data of multifactorial regressive analysis in the group of vaccinated children**

Parameters	Tests	$\beta$	P
Enlargement liver	bilirubin	0,96	p<0,001
-	total protein	0,56	p<0,01
-	albumin	0,58	p<0,01
-	ASAT	0,35	p<0,05
-	IL-1	0,99	p<0,001
-	IL-2	0,98	p<0,001
-	IL-6	0,32	p<0,05
-	IL-10	0,73	p<0,001
-	Iron	0,37	p<0,05



-	Iodine	0,96	p<0,001
Increased liver echogenicity	bilirubin	0,95	p<0,001
-	total protein	0,56	p<0,01
-	albumin	0,58	p<0,01
-	ASAT	0,35	p<0,05
-	IL-1	0,99	p<0,001
-	IL-10	0,74	p<0,001
-	Iron	0,38	p<0,05
-	Iodine	0,96	p<0,001
Enlargement of the pancreas	bilirubin	0,99	p<0,001
-	total protein	0,55	p<0,01
-	albumin	0,58	p<0,01
-	ASAT	0,35	p<0,05
-	IL-1	0,99	p<0,001
-	IL-2	0,98	p<0,001
-	IL-10	0,73	p<0,001
-	Iron	0,38	p<0,05
-	Iodine	0,98	p<0,001

Increased liver echogenicity is interconnected with the levels of total protein ( $\beta = 0,69$ ), albumin ( $\beta = 0,88$ ) and ALT ( $\beta = 0,47$ ). Enlargement of the pancreas is caused by direct bilirubin levels ( $\beta = 0,70$ ), total protein ( $\beta = 0,88$ ), ALT ( $\beta = 0,46$ ) and IL-2 ( $\beta = 0,42$ ). We discovered the dependency of the progress of measles on the level of Iodine ( $\beta=0,96-0,98$ ), ( $p<0,001$ ) in the case of vaccinated children, according to ultrasonography. The statistics also demonstrates high mutual dependency of Cytocines (IL-1,2,6,10) and microelements state of vaccinated children, especially on Iron and Iodine. It means there is a process of complex activation of the minerals in all systems of child body as a reaction to the illness. It is advisable to

apply appropriate immunological mineral diet to improve the curation.

### Conclusion

We recorded mutual dependency of the development of morphofunctional features of measles on the level of Iodine ( $\beta=0,96-0,98$ ) in the case of vaccinated children according to ultrasonography. The statistics also shows high mutual dependency of including of Cytocines (IL-1,2,6,10) and microelements state of vaccinated children, especially on Iodine and Iron, i.e. complex activation of all the systems of child body takes place, which proves the necessity of immunological mineral correction for better curation.

**Summary.** During the analysis of the data concerning vaccination against measles we recorded no clear bio-chemical regional difference. That's why the analysis concentrates on the very fact of vaccination.

Comparative analysis of the vaccinated and non-vaccinated group shows substantial difference in the majority of parameters. As we can see, the progression of illness is more complicated in the case of



non-vaccinated children, for example, light sensitivity – 24 (36,36%) to 40 (57,97%), ( $p < 0,05$ ), dyspnea – 12 (18,18%) to 35 (50,72%), ( $p < 0,001$ ), sparse stool – 23 (34,85%) to 52 (75,36%), ( $p < 0,001$ ). In the case of 39 (59,09 %) vaccinated children catarrh syndrome was more extended than in the case of nonvaccinated ones – 24 (34,78 %), ( $p < 0,05$ ), but more than 5 days situation was reversed: 27 children (40,91 %) and 45 (65,22 %) ( $p < 0,01$ ). Vaccinated children had high temperature (39-41C). ( $p < 0,01$ ), whereas for non-vaccinated children the temperature of 37-38 was typical ( $p < 0,05$ ). The period of fever was longer in the case of non-vaccinated children  $6,16 \pm 0,15$  days, than in the case of vaccinated –  $5,75 \pm 0,41$  days.

Highly liable was indicative of complications: acute unilateral pneumonia 3 (4,55%) to 10 (14,49%) children, ( $p < 0,05$ ), acute bilateral pneumonia 4 (6,06%) to 6 (8,70%) children, acute bronchiolitis – 1 (1,52%) to 11 (15,94%) ( $p < 0,01$ ), acute bronchitis – 11 (16,67%) to 20 (28,99%) and acute obstructive bronchitis – 5 (7,58%) to 8 (11,59%) children. To sum up, in the case of 24 vaccinated children (36,38 %) and 55 non-vaccinated (79,71%) we recorded complications with the respiratory system.

These non-vaccinated children complications were under curation for a longer period of time. Highly representative is the data concerning curation up to 5 days which is 20 times more typical for vaccinated children ( $p < 0,001$ ), whereas curation up to 10 days is 5 times more typical for non-vaccinated children ( $p < 0,05$ ).

In the group of non-vaccinated children we recorded the decrease of Copper and Iodine in blood ( $p < 0,05$ ) compared to vaccinated children. According to our data, there is significant dominance of IL-1 ( $p < 0,01$ ) and IL-6 ( $p < 0,01$ ) in the case of non-vaccinated children, which correlates with catarrh period up to 5 days and up to 5 days of fever. These results can be explained by the fact, that IL-1 is responsible for the local inflammation and reaction of body in the case of infection. IL-6 is one of the most active cytokines which react on inflammation. They are also authentic pyrogenes.

Our data presented communication hepatomegaly caused by the level of direct bilirubinum ( $\beta = 0,38$ ), ALAT ( $\beta = 0,56$ ), IL-6 ( $\beta = -0,42$ ) and level iron of blood plasma ( $\beta = -0,56$ ) in the non-vaccinated children. Increased liver is interconnected with the levels of total protein ( $\beta = 0,69$ ), albumen ( $\beta = 0,88$ ) and ALT ( $\beta = 0,47$ ). Enlargement of the pancreas is caused by direct bilirubin levels ( $\beta = 0,70$ ), total protein ( $\beta = 0,88$ ), ALT ( $\beta = 0,46$ ) and IL-2 ( $\beta = 0,42$ ).

**Key words:** children, measles, vaccination.

### Особливості перебігу кору у дітей

Горленко О.М., Поляк М.А., Поляк-Товт В.М., Гема Н.М., Горленко Ф.В., Піриді В.Л.

**Резюме.** В результаті клініко-параклінічного аналізу даних перебігу кору в залежності від проведеної вакцинації були отримані такі дані. У дітей, вакцинованих проти кору, захворювання перебігало переважно в легкій формі та мало неускладнений перебіг (63,8 %) на відміну від не щеплених дітей, де переважали тяжкі та середньотяжкі форми (81,1%). У (79,7%) хворих відзначені ускладнення з боку органів дихання. В обох групах спостерігалися високі рівні IL-2, IL-6, IL-10, ІФН- $\gamma$  та неоптерину. За нашими даними, було вірогідне переважання рівнів IL-6 у не вакцинованих дітей ( $44,59 \pm 5,21$  пг/мл проти  $28,04 \pm 5,71$  пг/мл,  $p_{1,2} < 0,01$ ) відповідно по групах, що корелювало з тривалістю катарального синдрому більше 5 днів у 27 вакцинованих дітей (40,91%) проти 45 не вакцинованих дітей (65,22%,  $p < 0,01$ ) та тривалістю лихоманки ( $5,75 \pm 0,41$ ) проти ( $6,16 \pm 0,15$ ) днів відповідно по групах. Спостерігалось зниження рівня міді у вакцинованих та невакцинованих дітей ( $0,41 \pm 0,04$  проти  $0,64 \pm 0,04$  мг/л відповідно по групах,  $p < 0,05$ ) та йоду ( $69,9 \pm 0,58$  проти  $64,7 \pm 0,69$  ммоль/л відповідно по групах).

**Ключові слова:** діти, кір, вакцинація.

### LITERATURE

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